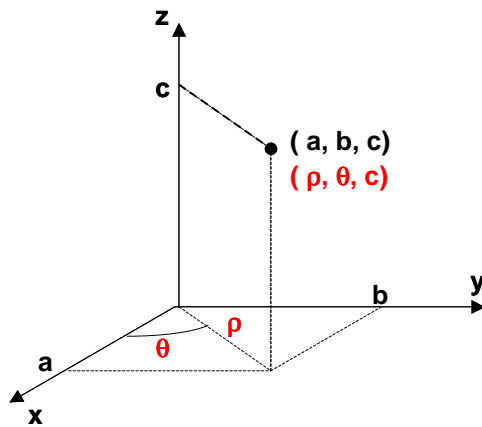
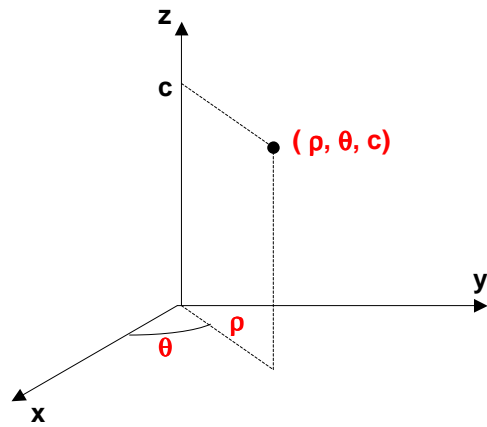
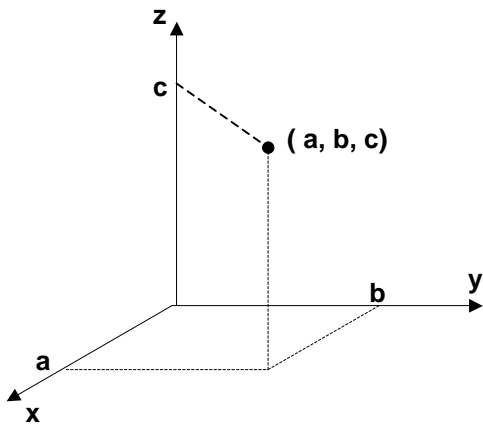


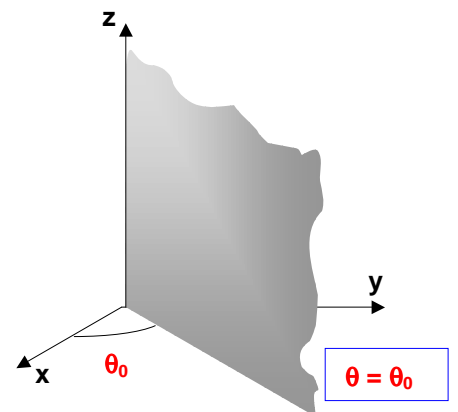
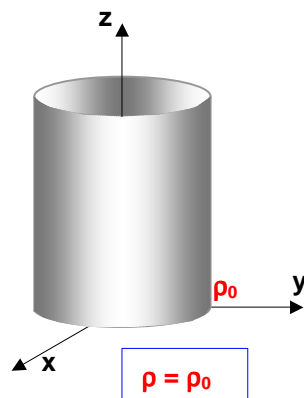
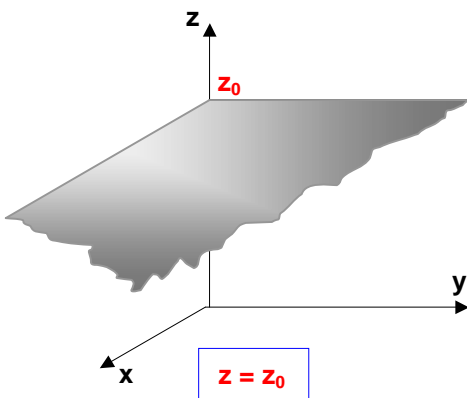
## Coordenadas cilíndricas



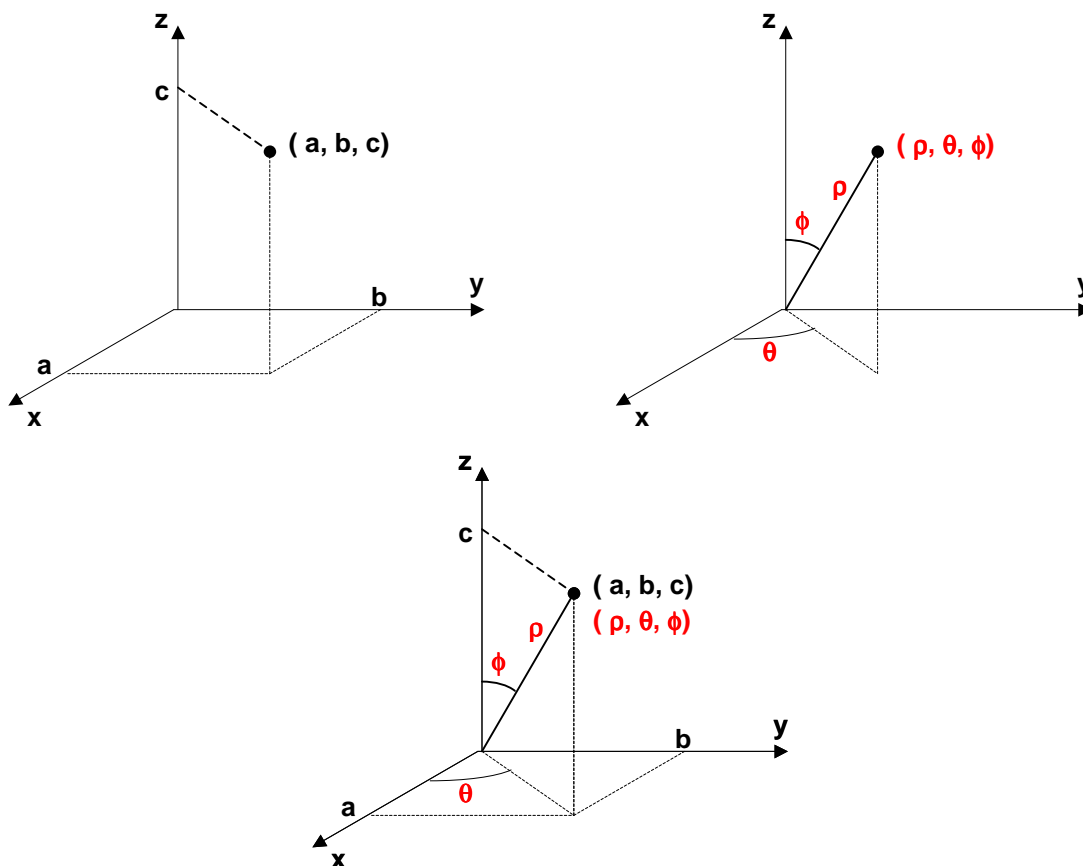
Cambio de coordenadas:

$$\begin{cases} x = \rho \cos \theta \\ y = \rho \sin \theta \\ z = z \end{cases} \quad |J| = \rho$$

$$\iiint_Q f(x, y, z) \, dx \, dy \, dz = \iiint_M f(\rho \cos \theta, \rho \sin \theta, z) \cdot \rho \, d\rho \, d\theta \, dz$$



## Coordenadas esféricas



Cambio de coordenadas:

$$\left\{ \begin{array}{l} x = \rho \operatorname{sen} \phi \cos \theta \\ y = \rho \operatorname{sen} \phi \operatorname{sen} \theta \\ z = \rho \cos \phi \end{array} \right\} \quad |J| = \rho^2 \operatorname{sen} \phi$$

$$\iiint_Q f(x, y, z) \, dx \, dy \, dz = \iiint_M f(\rho \operatorname{sen} \phi \cos \theta, \rho \operatorname{sen} \phi \operatorname{sen} \theta, \rho \cos \phi) \cdot \rho^2 \operatorname{sen} \phi \, d\rho \, d\theta \, d\phi$$

